Chapter 10
IoT-Based Design and Execution of Soil Nutrients Monitoring

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ABSTRACT

A sensor centers on using detectors beneath the surface of the soil. The applications require the sending of sensors beneath the ground surface. Henceforth, the sensors turn out to be a piece of the detected condition and may convey more exact detecting. Sensors like NPK (nitrogen, phosphorus, and potassium), soil moisture, and humidity are underground and impart through soil. Most of the applications for sensors are shrewd farming, natural observing of the soil, etc. In this chapter, moisture substance, NPK level of the soil in land is estimated utilizing the sensors, which send it to the centralized server through internet of things for checking. The authors introduce propelled channel models to portray the underground remote channel to consider the qualities of the expansion of electromagnetic waves in the soil. From this detection of soil, one can increase crop production as per the wealth and nutrient levels of soil.

INTRODUCTION

Agriculture is the major source of livelihood for more than 40 percent of the population of the State. Farmers act as pillars in providing relentless and unmatched service to the ever-growing demands of the populace. Prediction of the soil nutrients level in the agricultural area seems to be the foremost and

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important task for farmers as it enables them to increase crop productivity and ensure surplus growth. This research work is initiated with the belief that it helps farmers and the agricultural sector as a whole in producing healthy crops thereby contributing in large measure to the nation's economy and progress.

Incomparably, food is the chief source of livelihood throughout the world. In order to remain healthy and lead an active lifestyle, the contribution of food with all its vital nutrients remains unsurpassed. Hence to obtain high quality crop with greater yield, a smart agro device is chosen such that it sends soil related information on an hourly basis to farmers and agriculture experts to ensure timely monitoring.

The main problem that lingers in the lack of high crop yield lies in the improper identification and selection of micronutrients and macronutrients of the soil. These macro and micro nutrients play a much bigger role in the growth of crops and influence their productivity to a considerable extent. Absence of any one of the micronutrients in the soil can limit and disrupt the growing nature of plants even when all other nutrients are present in adequate quantities. The proposed study aims at calculating the actual availability of the micro and macro nutrients with the help of sensor technology and validating them with traditional values. Depending on the compatibility, a farmer communication system will be identified which will be useful for farmers in knowing the nature of their crops and thereby devise suitable improvements. Along with the micronutrients, electrical conductivity, humid matter and other physical parameters required for enhanced growth also will be validated. This requires the collection of relevant information and identifying the use of multiple sensors in lieu of traditional wireless systems using processor. This being said, identifying the type of crop & proper fertilizers suitable for the soil to enhance the crop yield is quite a difficult task. Hence a user-friendly communication system will be designed to give timely information to farmers.

The proposed research work aims at developing and enhancing the agricultural sector with the help of its newly invented Smart Agro Device that aids in measuring the micronutrients, macronutrients and other physical parameters of the soil. It assists in choosing the suitable crop for any given piece of land as per the nutrients level to enable high crop yields. The device goes a long way in the design and development of sensors for soil nutrients, micro nutrients, soil temperature, moist and PH and macronutrients like Nitrogen (N), Phosphorous (P) and Potassium (K) of the soil. It calibrates sensor values with traditional testing method values. All the sensor parameters are interfaced with the processor and updated through IOT technology and validated with soil testing laboratories. The proposed research work also utilizes renewable energy sources for power supply (Swapna et al., 2019, pp. 1-7).

To design the micro and macronutrients sensor, a survey about sensor design was done, which measures the soil nutrients level for soil quality and crop selection. The sensor is then tested to estimate the value of soil nutrients. According to this measurement, the code was designed and developed for interfacing with high efficiency. The nutrients values were evaluated from sensors and interfaced with the processor. These values were compared with the traditional method to find the soil nutrients value in the government agriculture department (Ramane et al., 2015, pp. 66-70).

Sensors are available for measurement of soil moisture, humidity, temperature, dust, etc. For Nutrients level measurement, compact and IoT enabled sensors that are cost effective are not available in our country (Vuran & Silva, 2009a, pp. 25-36).

Data from the proposed prototype remains the same as the traditional values from the soil testing laboratory. Soil nutrients measurement values will be updated through the Internet of Things. Smart Agro Device is a wonderful and gifted man-made wireless device for farmers to receive soil parameters (Rashid, 2016, pp. 1-7). Sensors like moisture, temperature, pH, and soil nutrients are interfaced with the processor which is connected to a renewable source like a solar panel. Data received from different